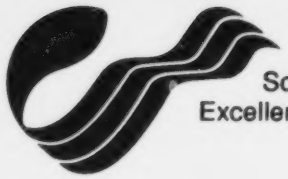

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Canada's Oceans

An Economic Overview and a Guide to Federal Government Activities
(1989 Edition)

Economic and Commercial Analysis
Report No. 43

Fisheries and Oceans | Pêches et Océans

Canada

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DU GOUVERNEMENT FÉDÉRAL."

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FOREWORD TO SECOND EDITION

This edition is an update of the 1987 DFO publication "Canada's Oceans - An Economic Overview and a Guide to Federal Government Activities". Since the time of the original publication, the world price of oil has dropped, which has caused a decline in the offshore oil and gas industry. The shipbuilding and repair industry has experienced diminishing demand and increased competition which has resulted in decreased output. These declines have caused a downturn in the oceanic manufacturing and services industries.

The roles and responsibilities of some federal departments and agencies regarding the oceans have also changed. The Atlantic Canada Opportunities Agency (ACOA) and the Western Diversification Office were created, along with Industry, Science and Technology Canada (ISTC).

With regard to oceans policy, the Minister of Fisheries and Oceans announced in 1987 a policy to set the framework and a strategy to meet the challenges and opportunities on the oceans frontier. The policy objectives and strategy initiatives were outlined in the 1987 publication entitled "Oceans Policy for Canada". In 1988 the Minister of Fisheries and Oceans announced the creation of a National Marine Council to advise him on oceans-related policies and issues. Implementation of the other strategy initiatives is proceeding.

EXECUTIVE SUMMARY

Economic growth generated from the exploitation of Canada's oceans and oceans space represents an important element of the country's economy and will continue to do so in the future. This study provides an overview of Canada's oceanic economy and of current activities of federal government departments and agencies having responsibilities involving the oceans.

The Economic Importance of Canada's Oceans

More than $6 billion and 165,000 jobs are directly attributable to the use of Canada's oceans resources and oceans space.

Each of the major components of the oceans economy sector is discussed in this study, with emphasis on current economic conditions and future prospects for economic development.

Canada's oceanic industries compete in an environment where survival and success require world-class expertise. Canada now leads in many areas of ocean technology and there are several reasons why ocean science and technology are of strategic importance to Canada's national priorities:

(a) The sheer size of Canada's oceans jurisdiction entails major management responsibilities with respect to the use of the waters themselves and the resources in and below them. Knowledge, understanding and technology are the keys to successful management which in turn is perhaps the strongest expression of sovereignty.

(b) If Canada is to control its oceans development, it cannot be totally dependent on foreign suppliers for the necessary tools to accomplish it. Furthermore, there are clear advantages that arise from being the first to develop and make use of new technology.

(c) Resource-based industries such as the fishing and hydrocarbon industries, as well as other ocean industries such as shipping, shipbuilding, and aquaculture, need continued access to leading-edge technologies if they are to remain competitive.

(d) There are numerous areas where Canada already has developed, or has the potential to develop, world-class technological capabilities. These are demonstrated and tested in the world arena. This is particularly important in terms of the opportunities created as developing countries begin to take on the responsibilities of managing their ocean jurisdictions and developing their ocean resources.

(e) Significant growth potential exists for the industrial sectors which supply the technology needed for worldwide oceans development; this requires recognition of the significance of technological applications by government, industry and universities.

(f) The technology impetus generated by the offshore petroleum activities of the last decade has been temporarily reduced by the shift in the oil supply/demand balance. It is important to ensure that this crucial technology will be in place when oil and gas activity resumes. Diversified applications of oil- and gas- related technologies will be necessary to sustain continued R&D in this area.

Federal Oceans Activities

The federal government has broad responsibility for the stewardship of Canada's oceans territory and resources. Federal expenditures on oceans-related activities amount to approximately $1.5 billion annually and have a human resource requirement of more than 13,000 person-years (excluding $2.2 billion in annual expenditures and 18,448 persons dedicated to the Maritime Command operations of the Department of National Defence). These activities are undertaken pursuant to approximately 70 programs operated by 14 federal departments and agencies.

Federal oceans activities can be categorized according to seven broad functions. These categories are:

(1) marine transportation;
(2) other marine transportation services;
(3) resource development and management;
(4) sovereignty, defence and law of the sea;
(5) northern development;
(6) industrial development; and
(7) marine science and technology development.

While many oceans-related programs have more than one objective, they have been categorized in this inventory according to their **primary** objectives. For this reason, certain areas may appear under-represented in the inventory section of this study.

In addition to specific oceans-related programs, the Government of Canada has a broad range of policies in place which serve as mechanisms to promote the development of the oceans economy as a national priority.

ECONOMIC OVERVIEW OF THE OCEANS SECTOR

More than $6 billion of Canada's national income and more than 160,000 jobs come directly from the oceans. Table 1 presents estimates of current gross output (expenditures) and employment for selected oceans-sector activities:

Table 1. ESTIMATED OUTPUT AND EMPLOYMENT FOR SELECTED OCEAN SECTOR INDUSTRIES

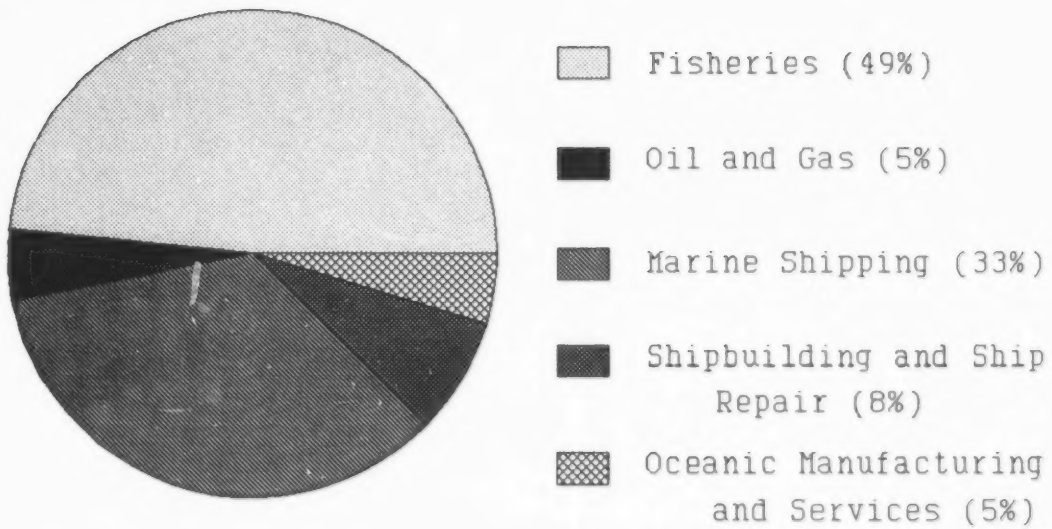
INDUSTRY	YEAR*	OUTPUT ($Billion)	EMPLOYMENT** ('000)
Fisheries	1988	3.2	124.0
Oil and Gas	1988	0.3	1.6
Ocean Mining	1988	-	-
Marine Shipping	1987	2.2	23.8
Shipbuilding and Ship Repair	1988	0.5	7.8
Oceanic Manufacturing and Services	1986	0.3	6.2
Total		6.5	163.4

* most recent available data are presented in Table 1.

** represents jobs and not necessarily person years of employment

The relative contribution of the ocean sector industries is presented in Figure 1:

Figure 1. CONTRIBUTION TO OUTPUT BY SELECTED OCEAN SECTOR INDUSTRIES



Fisheries

The value of Canadian *commercial fisheries* production in 1988 was $3.2 billion of which $2.7 billion was exported. In terms of value, Canada is the leading exporter of fish products in the world. The total number of licensed fishermen in the sea fisheries was 86,000 in 1988. There were also 38,000 plant workers. Many fishermen and plant workers worked seasonally.

Canada enforces its 200 nautical mile fisheries jurisdiction with diligence. The Department of Fisheries and Oceans patrols fishing vessels both within Canada's jurisdiction and in certain waters managed by the Northwest Atlantic Fisheries Organization (NAFO). In 1988, 59 foreign vessels were detained for various suspected violations, including unauthorized entry and unauthorized fishing in Canadian fishing zones.

Commercial fisheries account for less than one per cent of Canada's GNP; in the provincial economies of Atlantic Canada, however, they play a far greater role. More than one-quarter of Atlantic Canadians live in about 1,300 small fishing communities, half of which are single-sector fishing communities. In 1988, there were more than 870 fish plants employing 30,000 workers, and close to 30,000 vessels employing some 64,000 full- and part-time fishermen.

In Atlantic Canada, there are thousands of seasonal fishermen working from relatively small-scale craft (less than 35 feet) generally within 12 miles of the mainland and accounting for close to one-quarter of total landings and close to one-third of total value in 1988. There are also vertically integrated fish companies which operate year-round trawler fleets targeted primarily on groundfish out to the 200-mile limit.

The economic health of the inshore sector varies across the Atlantic region. In some areas, such as northeast Newfoundland, the industry traditionally has been unable to provide adequate incomes to participants. In others, such as southwest Nova Scotia, many fishermen are able to derive good incomes from the inshore fishery.

An on-going problem facing the Atlantic fishery is the surplus fishing capacity resulting from over-investment following the 1977 extension of the fishing zone to 200 miles. In the early 1980s, high debt exposure at a time of increasing interest rates and intense competition pushed the industry to the brink of financial collapse. A major restructuring and refinancing plan was negotiated in 1983 among the large major offshore companies, their creditors and the federal and provincial governments. Three major companies were formed: Fishery Products International based in Newfoundland; National Sea Products based in Nova Scotia; and Pêcheries Cartier Inc. based in Québec. Pêcheries Cartier Inc. has since been sold, while National Sea Products and Fisheries Products International are Canada's largest fish processors.

Fish resources of the Pacific coast are exploited by commercial, recreational and Indian food fisheries. The most important species is salmon. The commercial salmon fleet had about 4,600 vessels in 1988, accounting for about 92 per cent of the total salmon catch.

In British Columbia, the commercial fisheries are the basis for much of the economic activity in 94 small fishing communities outside the industrial triangle of Vancouver, Victoria and Nanaimo. Many of these are single-sector communities. The commercial fishery employs 20,000 full- and part-time fishermen. The processing sector has about 170 plants and 7,000 employees.

In the Pacific fishery, catches have been good and the industry has recovered from the over-investment of the early 1980s, when debt exposure, coupled with over-capacity and declining stocks, resulted in substantial losses for the fishing fleet and bankruptcy for many small and medium-sized processors. A successful stock recovery program, along with sound management and conservation practices, are crucial if the industry is to remain profitable. The Salmonid Enhancement Program (SEP) is an important element in the management of west-coast salmon fisheries. This Department of Fisheries and Oceans (DFO) program uses a variety of scientific techniques, ranging from the simple to the extremely complex, to enhance the natural production of salmonids. It makes a critical contribution to preserving fish habitat and generating employment in fish production, harvesting and processing.

Aquaculture currently represents only three per cent of the value of fisheries landings, but is beginning to establish itself as an important component of the Canadian fishery. Salmonids and molluscs are the major species. Total aquaculture production in 1988 was 18,000 tonnes. Aquaculture is expected to continue to expand at a rapid pace, with anticipated output of up to $1 billion by the year 2000. There are 1,500 person-years of employment, and due to the seasonality of the industry there are many more jobs during peak periods. There are also hundreds of indirect jobs associated with aquaculture supplies and services.

The value of **recreational fisheries** is more difficult to estimate than that of commercial fisheries since the market values for the recreational fisheries are not known. Recreational fishermen are surveyed every five years by DFO. The next survey will be conducted in 1990. On the Pacific coast alone, expenditures on support industries attributable to saltwater recreational fishing (e.g., equipment, boats, bait, accommodation, etc.) were approximately $402 million in 1985. The 1985 Survey of Sportfishing in Canada found that 38 per cent of direct expenditures were on food and lodging, 32 per cent on transportation, 14 per cent on fishing supplies, 11 per cent on vacation packages and 5 per cent on fishing services. Recreational activities, including recreational fishing, are expected to increase in the future with projected steady increases in leisure time, general increases in wealth, and a substantial increase in the population over 60 years of age.

Fisheries Outlook

There is potential for fisheries resource growth on the Pacific and Atlantic coasts, particularly for the SEP-related growth of salmon fisheries in the Pacific. Canada may also have opportunities to expand fish exports significantly over the next decade especially for value-added products. The key areas where ocean science could contribute to the future development and growth of the fishing industry include:

- o improvements in vessel and gear technology;
- o increased understanding of fish population dynamics, especially for factors affecting recruitment;
- o an ocean mapping program; and
- o improved knowledge of the distribution and abundance of fish, marine mammals and marine vertebrates, particularly in boundary dispute areas, at the edge of the 200-mile fishing zone and in the Arctic.

Oil and Gas Exploration and Development

Canada's offshore areas contain substantial hydrocarbon resources. Of those resources discovered to date on Canadian frontier lands (Yukon and Northwest Territories, Hudson's Bay and most offshore areas in Canada), 90 percent of the oil and 75 percent of the gas lie offshore. Of the 139 significant discoveries on the entire frontier lands to date, 82 have been found in offshore areas. In some of the major frontier areas, at least one large pool of oil or gas has been discovered and delineated. In the east-coast offshore, development plans and approvals have been submitted for the Venture gas development project (Scotian Shelf) and the Hibernia oil project (Grand Banks).

Development projects in the Canadian offshore are being planned at this time. On July 18, 1988, the Prime Minister signed a statement of principles to proceed with the development of the Hibernia oil field, and conclusion of negotiations between all parties involved is now expected for mid-1990. The project represents an $8.5 billion capital investment, of which $5.2 billion will be spent prior to production. There will be a seven year construction period, followed by an eighteen year production period. The facility is expected to produce 110,000 barrels/day. Another east coast development project which could also start in the 1990s is the Terra Nova field. These development projects will undoubtedly require higher oil prices.

The oil and gas industry invested heavily in exploration and development work in the offshore areas of the frontier lands. From 1982 to 1988, expenditures for offshore drilling totalled more than $8 billion. Exploration and development expenditures for 1988 are summarized in Table 2.

The recent decline in drilling activity has been caused by low international oil prices and the fact that the drilling requirements of the original exploration agreements were fulfilled between 1982 and 1985, resulting in a very high level of activity during that period. Operators are now interpreting the results of this drilling and waiting for an improved economic climate before embarking on future exploration activities which tend to be cyclical in nature. For example, two complete cycles of activity have occurred in the east-coast exploration areas between 1970 and 1988.

Canadian offshore exploration faces unique challenges such as great distances from supply bases and exposure to open ocean weather, drifting pack ice, icebergs and multiple-year ice

in the Arctic Ocean. To meet these challenges, new technologies, improved scientific information about the environment and specialized scientific services will be required. The Ocean Ranger disaster made us all aware that there continue to be risks associated with activities carried out in the oceans. The federal government's response has resulted in increased weather support and search and rescue activities as well as research and development efforts in support of ocean safety.

Table 2. TOTAL 1988 CANADIAN PETROLEUM INDUSTRY EXPENDITURES ON THE OCEANS FRONTIER

	Exploration ($ million)
Beaufort Sea	126.6
Arctic Islands and Eastern Offshore	0
Newfoundland Offshore	159.8
Nova Scotia Offshore	43.2
TOTAL	329.6

Source: The Canada Oil and Gas Administration Annual Report 1988

Ocean Mining

Historically, the private sector has not shown a great deal of interest in exploring and developing offshore mineral deposits within Canadian jurisdiction. This has been due to several factors:

- o the potential has not been fully investigated;
- o relevant geological and technical information has been unavailable;
- o investor uncertainties concerning federal and provincial jurisdictions; and
- o unresolved legal issues with respect to the ocean mining provisions of the 1982 Convention on the Law of the Sea.

More than 20 million cubic metres of sand and gravel have been mined from the Canadian Beaufort Sea since 1972 to construct artificial islands in support of oil and gas

development. This makes it the largest dredging project in the Canadian offshore. There is a licensed mining operation for nearshore sand and gravel in the Prince Rupert area. Small amounts of sand and gravel have been dredged from nearshore waters off Newfoundland. There have also been exploration activities to delineate gold deposits off Nova Scotia and silica sand deposits off the Magdalen Islands and heavy minerals offshore Newfoundland.

Gold, silica sand and sand and gravel deposits in Canada's oceans have the greatest likelihood of being developed within the foreseeable future. Although there are other minerals which could be mined, there is no evidence that their production would be particularly profitable.

Department of Energy, Mines and Resources forecasts, based on current consumption and production, size and distribution of offshore deposits and markets, indicate that ocean mining production by the end of the century could range from $25 million to $400 million. East coast production will likely be more significant than west coast production. Sand and gravel estimates are based on domestic market requirements. Since sand and gravel are known to occur widely and the area of seafloor for the required yields is small, it is assumed that sufficient supplies exist on both coasts. The production of silica sand is also based on domestic market requirements and resources in known deposits. Development potential seems excellent for the east coast but limited on the west coast. For both Nova Scotia and British Columbia, the likelihood of offshore gold production is high, although uncertainties exist concerning the nature, extent and grade of deposits and the price of gold in the future.

Neither the by-product recovery and sales nor the mineral resources in the Arctic are considered in the above estimates although some potential may exist for gold-bearing sands. The technology for Arctic offshore mining exists as demonstrated by sand and gravel dredging. In addition, tin placers are mined in the Soviet Arctic.

Development of non-fuel minerals offshore may one day offer commercial opportunities for the Canadian private sector. However, the economic potential of non-fuel minerals offshore, with the possible exception of aggregates such as sand and gravel, is modest given current market conditions.

Another area with potential is the mining of oceans mineral resources beyond the limits of national jurisdiction. Over the past 15 years, multinational consortia which include Canadian interests, have invested in ocean mining exploration. For the foreseeable future, however, economic factors and legal uncertainties will hinder more rapid development. Canada is actively involved in efforts to resolve outstanding legal issues. Canada participates in the work of the Preparatory Commission for the United Nations Convention on the Law of the Sea in order to promote the development of a deep seabed mining regime that encourages universal acceptance of the Convention. When the Preparatory Commission completes its complex task, Canada will be in a position to determine whether to ratify the Convention.

Marine Shipping

Although there are more than 300 active shipping ports in Canada, activity is concentrated in terms of tonnage loaded and unloaded. The ten leading ports handled 60 per cent of total gross tonnage in 1987, while 74 per cent was handled by the leading 20 ports. In 1987, approximately 362 million tonnes of cargo was handled in Canadian ports. Of this amount, about 135 million tonnes or 37 per cent represented domestic shipping operations while the remainder was international shipping.

Table 3. CANADA'S LEADING PORTS, IN TERMS OF LOADED AND UNLOADED CARGO TONNAGE, 1987

PORT	DOMESTIC AND INTERNATIONAL TOTAL ('000 t)	%	DOMESTIC TOTAL ('000t)	%	INTERNATIONAL TOTAL ('000t)	%
Vancouver	64,630	17.8	4,350	3.2	60,280	26.6
Port-Cartier	23,120	6.4	4,683	3.5	18,437	8.1
Montréal/ Contrecoeur	21,436	5.9	7,371	5.5	14,065	6.2
Sept-Iles/ Pointe-Noire	19,648	5.4	4,311	3.2	15,337	6.8
Thunder Bay	19,355	5.3	15,878	11.7	3,477	1.5
Quebec/Lévis	18,262	5.0	6,747	5.0	11,515	5.1
Halifax	15,082	4.2	3,629	2.7	11,452	5.0
Prince Rupert	13,805	3.8	705	0.5	13,100	5.8
Saint John	12,988	3.6	1,849	1.4	11,139	4.9
Hamilton	10,935	3.0	4,920	3.6	6,015	2.6
Ten Leading Ports	219,259	60.4	54,442	40.3	164,817	72.6
Twenty Leading Ports	267,309	73.8	74,346	55.0	192,963	85.0
All Canadian Ports	362,164	100.0	135,145	100.0	227,019	100

Source: Statistics Canada
Transportation Division

In 1987, there were 303 Canadian domiciled carriers. They owned and operated 2,000 vessels and employed almost 24,000 persons, of which about 15,000 were crew. They generated a gross operating revenue of $2.2 billion. A breakdown of these revenues is presented in table 4.

Table 5 provides a regional distribution of revenues. About 20 per cent of the revenues are from inland operations, 22 per cent are from operations in the Pacific and the remainder is split among operations in the Atlantic and Northern regions. The West Coast operations are mainly tugs and barges while east coast operations are mainly small coastal freighters.

Canada has concentrated on the development of its seaway fleet because of its importance to the domestic economy and the need for efficient, economical transportation of the country's resource materials, leaving deep sea business to operate under international competitive market conditions. More recently, however, lake vessels have been built with ocean-going capabilities. As the aging domestic fleet is gradually replaced, Canada may have some potential in the long term to increase its share of international shipping.

Table 4. 1987 MARINE SHIPPING STATISTICS

TYPE OF CARRIER	No. of Carriers	Revenue ($ million)	No. of Vessels	Crew	Wages ($ million)	Other Related Employment	Wages ($ million)
FOR-HIRE	237	1,277	1,246	6,586	264.9	2,261	63.5
PRIVATE	40	379	217	1,050	42.0	298	12.7
GOVERNMENT	26	521	538	7,670	237.1	6,007	264.1
TOTAL	303	2,177	2,001	15,306	544.0	8,566	340.3

Source: Statistics Canada
Transportation Division

Table 5. WATER TRANSPORTATION REVENUE, 1987
ALL CARRIERS, BY AREA AND BY TYPE OF OPERATION
($ '000)

AREA OF OPERATION	Transport of Commodities	Transport of Passengers	Chartering	Towing	Other	Subsidies	Total	Percentage of Total
Domestic								
Atlantic	113,485	17,760	47,725	8,640	16,262		203,872	10.3
Pacific	123,985	55,095	897	244,220	9,917		434,114	22.0
Inland	297,686	30,535	18,505	36,096	22,663		405,485	20.6
Arctic	24,329	0	10,104	1,705	10,700		46,838	2.4
MacKenzie	21,777	0	47	0	70		21,894	1.1
International	538,249	6,543	8,268	16,408	28,811		598,279	30.3
No Area Assigned			44,792			216,678	261,470	13.3
Total	1,119,511	109,933	130,338	307,069	88,423	216,678	1,971,952	100.0

Source: Statistics Canada
Transportation Division

Shipbuilding and Repair Industry

The Canadian shipbuilding industry is composed of 14 large shipyards, employing over 100 workers, and about 50 smaller yards and repair shops. The large yards contribute about 90 per cent of the employment and total value of Canadian shipbuilding and repairs. The governments of Newfoundland, Prince Edward Island and Quebec own or have an interest in a number of Canadian shipyards. Table 6 summarizes expenditures and employment in 1988 for the Canadian Maritime Industries Association (CMIA) member yards.

Table 6. SHIPBUILDING AND REPAIR VALUE AND EMPLOYMENT IN CMIA MEMBER YARDS (1988)

	EXPENDITURES ($ '000)	EMPLOYMENT
New Construction	$331,468	4,939
Repairs and Conversions	$213,591	2,909
TOTAL	$545,059	7,848

Source: Canadian Maritime Industries Association
Annual Statistical Review, 1988

Both expenditures and employment are expected to drop during the next decade, largely because of declines in shipbuilding activities due to overcapacity and increased international competition. However, certain Department of National Defence (DND) projects such as the construction of mine counter-measure vessels, frigates, and possible work on Grand Banks offshore development could increase employment above 1988 levels. There are shipbuilding and repair facilities in every province but Saskatchewan. In 1988, most employment was concentrated in eastern Canada.

Exports have decreased due to declining international markets and the erosion of Canada's competitive position in foreign markets as a result of the subsidies available to foreign shipyards. Canada's shipyards exported more than $300 million in 1982, but exports were only minimal in 1988. Domestic repair work has increased slightly and is expected to provide an element of stability.

Over the last ten years, new construction represented between 45 and 70 per cent of the total value of marine work in CMIA member yards. In 1988, 33 per cent of new construction was commercial, while 67 per cent was procured by government. These proportions are expected to reflect a large government presence for the next few years.

Canada's international competitiveness has been handicapped by heavy direct and indirect subsidization of foreign shipyards by their respective governments and in some cases, by wage and benefit packages far lower than those existing in Canada. The resulting loss of commercial orders from both domestic and foreign owners has caused major cash-flow reductions which, in turn, have severely hampered the ability of Canadian yards to modernize and to increase productivity to world standards. Other factors such as over-capacity, limited vertical integration, dependence on imported marine components and dumping in Canada by foreign companies have also militated against a stronger industry in Canada. Although Canadian shipyards have collective experience in the construction of a wide range of vessels and offshore oil and gas equipment, shipbuilding countries such as Korea, Japan, Brazil, China and those in Western Europe offer highly competitive facilities and wage rates.

World demand for shipbuilding declined between 1974 and 1978, particularly for new merchant ships, offshore equipment and Liquid Nitrogen Gas (LNG) and oil tankers. Since 1978, first the economic recession and then persistently high levels of industry overcapacity have contributed to an uneven and tentative recovery. The short-term forecast is poor.

In response to difficult times, many of the world's shipbuilding nations, particularly European nations and Japan, have implemented rationalization policies. Since 1975, the capacity of European yards has fallen by approximately 48 per cent and that of Japanese yards by 35 per cent. However, much of this capacity could be put back into production if demand picked up.

Overall capacity is forecast to remain stable in the medium term although its geographic distribution could change significantly. Shipbuilding industries in Korea and China are growing, largely at the expense of European yards. In the future, this growth is expected to affect Japan as well.

Korea's position in the world shipbuilding market has risen from twenty-third in 1973 to first in 1987. This rise has been due to technology spin-offs from Japan, cheap and abundant labour and the ability to produce a wide variety of ship types.

Canada is a marginal supplier and a price-taker in world shipbuilding. With only modest increases in demand predicted, the Canadian industry's major concern is to preserve the domestic market against increasing pressure from foreign countries.

Although tanker and bulk-carrier markets are in a position of over-supply, world demand is expected to revive by 1990 except for LNG tankers. It is anticipated that roll-on roll-off vessels, container vessels, and small general cargo vessels which are more versatile, will gain at the expense of large general cargo vessels. Offshore service vessels are poor short-term prospects for the shipbuilding industry, but demand should increase in the medium - to long-term particularly for larger, more powerful and sophisticated vessels.

Domestically, federal government procurement (primarily by DND, the Coast Guard, DFO and Public Works) is expected to constitute over 50 per cent of total new conventional

construction, mainly due to the large volume of government work projected over the next few years. These orders will temporarily obscure the effects of weak commercial demand.

Within the offshore exploration equipment sector, demand for semi-submersibles is expected to recover before demand for drillships and jack-ups. Semi-submersibles are expected to capture part of the drillship market. The most likely sources of growth for offshore production equipment are floating production systems, particularly ship-shaped systems, and sub-sea facilities. However, demand for offshore equipment depends on oil prices and the timing of development projects such as Hibernia.

Oceanic Manufacturing and Services

Canada is one of the few nations of the world with internationally competitive stature, technologies and capabilities in the multi-disciplinary fields of oceanography and hydrography. During the past 10 years, the Canadian oceanic private sector has acquired the field experience and has become sufficiently innovative with its own technologies and with the technologies of others to compete in markets abroad against the traditional leaders - the United States, the United Kingdom, France, the Netherlands- and now Norway and Japan.

The Canadian oceanic manufacturing and services industry has developed in response to the commercial opportunities created by the establishment of national institutes in marine, fisheries, environmental and resource sciences and engineering, government contracts and R&D spending, maritime defence requirements and in particular, the offshore oil and gas exploration activities of the past two decades.

The manufacturers have products, systems and software for oceanographic, hydrographic, diving and other operational marine applications, for marine-related remote sensing, submersibles and seabed systems. The services sub-sector covers a large range of activities based in engineering, sciences, consulting and surveying, including aerial surveying, with marine applications. All companies employ advanced technologies. Many of them also develop or adapt advanced technologies, systems and software for innovative applications.

There are currently about 500 to 600 companies forming the oceanic services and manufacturing sector in Canada. Governments are the most important customers, with the federal government, through several departments, institutes, agencies and special-purpose funds, the single biggest purchaser. In addition to direct purchases of goods and services for specific programs, federal funding of private-sector R&D is a significant factor in the financial health of participating firms and is the source of a wide variety of innovations in oceans-related products, systems, software, services and techniques. These are applied in Canada and in many cases, result in successful export activities. The domestic offshore exploration industry is currently the second largest overall customer for Canadian oceanic industry products and services. Its decline in the 1980's has led to a sharp decline in private sector demand in the oceanic manufacturing and services sector.

There is an evident entrepreneurial character in oceanic manufacturing and services. Canadian products and skills have been marketed and are being sold in more than 80 countries. The largest future market opportunities lie in the exploitation of Exclusive Economic Zones of developing coastal states.

The health and growth of Canadian oceanic manufacturing and services are tied largely to international conditions that are beyond Canadian control. These are both troubled and challenging times for many of Canada's small ocean manufacturing and services industry, an industry where international competitiveness is often a key to survival. Continuing federal expenditures provide a floor activity to support and maintain basic levels of employment on a year-to-year basis. Domestic fortunes fluctuate with the varying pace of exploration and delineation drilling offshore.

Sales estimates for the industry for 1984 and 1986 are provided in table 7. A DFO survey is currently underway that will update these estimates. Results are expected in 1990.

Table 7. OCEANIC MANUFACTURING AND SERVICES

FIRMS	No. of Firms	Sales 1984 ($ Million)	Sales 1986 ($ Million)
Oceanic Manufacturing (including 75 electronics firms)	200	200	150
Oceanic Services and Consultants (including engineering & surveying)	250	140	100
Diving Services	50	30	12
Estimated Total	**500**	**370**	**262**

The approximately 200 companies in the manufacturing sub-sector are concentrated in British Columbia, Alberta, Ontario, Québec, Nova Scotia and Newfoundland. Few of these companies are dependant exclusively on offshore oil and gas field exploration, development and/or production. Their technologies, products and related activities (service, maintenance and repair) are sold to a variety of ocean users in marine sciences, fisheries, marine transportation, environmental management and control, northern development, defence, aerospace and remote sensing, and offshore supply.

Most Canadian manufacturing firms are small, employing five to 50 people and are privately owned by entrepreneurs or employees, rather than publicly owned through Canadian stock exchange listings. Most have sales in the range of $500,000 to $10 million a year.

The manufacturing sector's 1985 total sales of all products including oceanic/marine products have been estimated by Industry, Science and Technology Canada (ISTC) to be in the range of $150 million to $200 million. Total employment is estimated to be at least 2,500.

Export markets throughout the world are extremely significant to this group, although there are wide disparities in the levels of involvement. ISTC has estimated that exports may represent up to 70 per cent of the annual total manufacturing sales of some firms. Principal market areas are the North Sea (U.K. and Norwegian sectors), southeast Asia, the Arabian Gulf, South America and the United States. The Canadian International Development Agency (CIDA) is and could become an increasingly important conduit for sales to developing countries.

The services sub-sector includes some 250 consultants, oceanographic, hydrographic, cartographic, geophysical, engineering, marine environmental, diving firms and ice specialists, concentrated in British Columbia, Alberta, Ontario, Québec, Nova Scotia and Newfoundland. Also, a segment of the aerial surveying industry provides a range of services.

Ocean services firms participate widely at all stages of ocean exploitation, beginning with the pre-exploration phase of scientific and environmental studies to supplement government in-house capabilities and activities, then expanding and changing focus throughout the extended period of exploration. The offshore field development phase, which takes about five years, requires a high degree of services involvement and the addition of a wider range of companies. Once production begins at an individual field, types of activities change in character, focusing on inspection, maintenance and repairs to offshore structures and sub-sea installations. At the same time, overall employment that is offshore production-related is reduced as jobs become operational in character.

The value of Canadian private-sector hydrographic, oceanographic and geophysical surveying in 1985 was estimated at $50 million but is expected to have dropped to $40 million or lower in 1986. The current level of export activity is estimated at approximately $10 million, with a potential of $50 million to $75 million or more.

Some 100 firms of all sizes have their primary business activity in one or more of the above three surveying fields. Another 75 or more firms include some of these services as part of their engineering consulting and services or in conjunction with conventional aerial surveying and remote sensing with marine applications. Some environmental consultants and firms in the fresh water field offer oceans-related services. A few very large firms offer a spectrum of such services at home and abroad. There are some 50 diving services firms, offering a variety of general and specialized skills. Some 25 of them are export-capable.

Annual total exports by services firms, including their non-oceanic activities, are currently estimated to exceed $50 million. Employment has fluctuated with the domestic and foreign economies and was estimated in 1986 to be approximately 3,500. Cutbacks in exploration activities since 1985, both Canadian and worldwide, will hurt the services sub-sector, particularly small, specialized firms which cannot diversify into other areas.

ROLE OF THE FEDERAL GOVERNMENT IN THE OCEANS SECTOR

The previous section of this study provides an overview of economic conditions in the various industrial components of the oceans sector. Before discussing federal government activities in detail, this section describes the overall role of federal government departments in oceans development and, in particular, the role of specific departments.

A Broad Overview

The federal government has broad legislative responsibility for the stewardship of Canada's oceans. That responsibility encompasses activities on, in and below the water, and extends to resources and resource users. The role of the federal government can be summarized as follows:

- o understanding the offshore environment and its resources;
- o encouraging economic development;
- o mediating conflicts between user groups;
- o protecting the common resource base and the marine environment;
- o providing infrastructure for safe navigation; and
- o preserving and enhancing Canadian sovereignty.

The federal role is carried out through an assortment of policies. Neither the policies nor the programs for implementing them are centralized within a single department or agency. Instead, some 14 primary departments and agencies administer approximately 70 programs which have a direct bearing on oceans, some of which are described below:

Fisheries and Oceans

The role of coordinating the policies and programs of the federal government respecting the oceans has been assigned by legislation to the Minister of Fisheries and Oceans. The duties, powers and functions of the Minister of Fisheries and Oceans, as defined in the Government Organization Act include:

> (a) all matters over which the Parliament of Canada has jurisdiction, not by law assigned to any other department, board or agency of the Government of Canada, relating to:
>
> i) sea coast and inland fisheries,
> ii) fishing and recreational harbours,
> iii) hydrographic and marine sciences, and
> iv) the coordination of the policies and programs of the Government of Canada respecting oceans.

(b) such other matters over which the Parliament of Canada has jurisdiction relating to oceans as they are assigned by law to the Minister.

Interdepartmental Committee on Oceans

The Interdepartmental Committee on Oceans (ICO), chaired by the Deputy Minister of Fisheries and Oceans, coordinates federal activities respecting marine science and oceanic programs. ICO has representation from all departments and agencies with oceanic programs, as well as those departments requiring services from such programs. The mandate for the ICO is:

- to review and facilitate the marine science operations in programs of the federal government, with particular attention to the sustainable economic development and stewardship of Canada's offshore jurisdiction;

- to develop a multi-year marine science plan for the federal government, bringing together in one comprehensive plan the marine science plans of the departments, and to update this plan annually;

- to prepare reports for the Minister of Fisheries and Oceans to present to Cabinet on the accomplishments of the government's marine science efforts;

- to ensure effective coordination of the federal efforts to foster the growth of an ocean industry in Canada, and to encourage the development and widespread private-sector use of marine data and forecasts.

This mandate is intended to raise the profile of the government's objectives in six areas of significant importance:

- sovereignty or sovereign rights in the offshore;

- economic viability for the fishing industry, and conservation of living marine resources;

- offshore resource exploration and exploitation;

- the development of a viable ocean industry which is competitive in world markets;

- the protection of the aquatic environment; and

- climate and weather prediction.

Aquaculture Agreements

In November 1986, First Ministers agreed that government attention be given to fostering the development of Canadian aquaculture. Fisheries Ministers subsequently decided that Federal-Provincial Aquaculture Agreements would provide the framework for this

development. Agreements have been reached with British Columbia, Québec, Nova Scotia, Newfoundland, Prince Edward Island, New Brunswick and the Northwest Territories. Negotiations for agreements with the other provinces are actively underway.

Industry, Science and Technology

The Minister of Industry, Science and Technology Canada (ISTC) has been charged with the responsibility of developing a national policy on science and technology. Towards this goal, a decision framework and a new Canadian Strategy for Science and Technology have been developed. These strive to enhance the relevance and effectiveness of federal expenditures in relation to government priorities based on economic and regional development needs, government missions and the general advancement of knowledge. Government has a basic role to create a climate which encourages innovation and entrepreneurship, the creation of future-oriented jobs and an improved focus on international competitiveness.

Energy, Mines and Resources

With respect to offshore oil and gas, the Department of Energy, Mines and Resources (EMR), DFO and other federal departments have responded to requests for improved scientific information about the environment as well as specialized scientific services, through major changes in their research programs and improvements in their formal data services. EMR programs, such as the Frontier Geoscience Program initiated in 1984, have provided geoscientific information to stimulate and facilitate exploration activities. The Federal Energy R&D Program under the Interdepartmental Panel on Energy Research and Development chaired by EMR has provided an opportunity to develop geoscience studies directly related to exploration for and exploitation of oil and gas reserves. DFO science programs have supplied special charts of production areas, information on sea and ice conditions, ocean chemistry and data on other areas of interest.

EMR is leading federal and provincial efforts to facilitate the environmentally sound development of offshore non-fuel mineral resources by providing appropriate information, establishing clear ground rules and addressing concerns related to environmental protection and fisheries. A number of cooperative efforts are being made in this regard:

o EMR has set up an Ocean Mining Citation Retrieval System and newsletter to provide the public and industry with information on various aspects of offshore non-fuel mineral development, compiled an inventory of available resource-related geological information from near-shore areas where most exploration and development will take place and sponsored a workshop on exploration and strategies and technologies;

o Efforts are under way to provide industry with a simple, stable set of ground rules for developing non-fuel minerals offshore that would accommodate the special conditions required for offshore operations. The use of uniform mining legislation for all offshore areas under both federal and provincial jurisdiction is being discussed and could be a key step to establishing the type of investment climate needed to

foster environmentally sound development;

o Environmental and fisheries protection would be an essential element of offshore mining legislation that would require that these and other socio-economic interests be considered in the early project planning stages of offshore development. In cooperation with interested provinces, efforts are being made to apply the experience of other countries when developing Canadian approaches;

o A Transition Strategy for addressing environmental and fisheries concerns has been implemented. One of the most important results has been the development of a prototype integrated resource management information system for the offshore area around Prince Edward Island.

National Defense

The Department of National Defence stands out as the largest single departmental consumer of oceans sector goods and services. Canada's Maritime Forces place substantial demands on oceans science, technology and service industries, both for small-scale needs as well as major capital construction projects. The ocean-sector support of defence industries occurs primarily in the oceanic manufacturing and services industry and the shipbuilding and repair industries. Defence spending contributes in a major way to the development of these industries.

o Maritime Command Forces and Air Command aircraft, under the operational control of Maritime Command, operate from seven bases, five stations, and two detachments, located primarily on the east and west coasts.

o The Canadian Patrol Frigate (CPF) project, to be completed in 1996 at a cost of $10.4 billion (Budget Year Dollars), will result in the construction of twelve warships to replace aging steam destroyers. The CPFs will be equipped with advanced communications, sensors and weapons systems and each ship will carry one Anti-Submarine Warfare (ASW) helicopter.

o The New Shipborne Aircraft Project is aimed at replacing Canada's 35 aging Sea King helicopters with between 28 and 45 new aircraft. The primary mission of these aircraft will be tasking for anti-submarine warfare and anti-surface surveillance and targeting with secondary capabilities for search and rescue, vertical replenishment (sling operations) and medical evacuation. Project completion is scheduled for 1996-1997 and total program costs could be in excess of $2 billion.

o Twelve Maritime Coastal Defence Vessels will be built in Canada and provided to the Naval Reserve for coastal patrol and mine countermeasures missions. The cost of this project will be $558 million.

o The Chief of Research and Development, with a 1988-89 budget of approximately $240 million, is responsible for R&D activities and scientific consultation aimed at enhancing the operational capabilities of the Canadian Forces. Slightly more than

one-third of the total R&D budget is devoted to maritime operations. Knowledge of oceans sciences is indispensable for efficient maritime operations. A greater understanding of the environmental parameters of the ocean as well as those of the atmosphere and the earth is essential for effective use of anti-submarine warfare systems by surface ships, submarines and marine patrol aircraft.

o The fleet's four DDH 280 Tribal class ships entered operational service in 1972 and 1973. They have reached their mid-life point and will be refitted and provided with a significantly enhanced capability under the $1.28 billion Tribal Update and Modernization Project. Two of the ships are currently undergoing this updating process.

Environment

Environment Canada has a broad range of responsibilities relating to the marine environment. Some of them include:

o Preserving and protecting the marine environment;

o Preserving and protecting natural and cultural heritage marine areas of Canadian significance;

o Providing adequate information for the safety and security of life and property in the marine environment;

o Ensuring maintenance of marine environmental quality for sustainable development and appropriate use of marine resources.

FEDERAL OCEANS-RELATED ACTIVITIES

To address coordination responsibilities more effectively in response to a request by the Prime Minister, the Minister of Fisheries and Oceans recently assembled an inventory of federal ocean activities. This inventory provides detailed descriptions of activities along with expenditure and person-year data. The inventory is summarized in this section.

Federal expenditures for oceans-related amount to approximately $1.5 billion annually and have a human resource requirement of more than 13,000 person-years (excluding $2.2 billion in annual expenditures and 18,400 person-years dedicated to the Maritime Command operations of DND).

Federal oceans activities can be categorized according to seven broad functions. They are:

(1) marine transportation
(2) other marine transportation services
(3) resource development and management
(4) sovereignty, defence and law of the sea
(5) northern development
(6) industrial development
(7) marine science and technology development.

A listing of the activities within these categories is provided in the Appendix, along with the departmental responsibility, the statutory authority and the financial and human resources associated with each.

While many oceans-related programs may have more than one objective, they have been categorized according to their primary objectives. For this reason, certain areas, most notably sovereignty and northern development, may appear somewhat under-represented. For example, fisheries resource allocation, offshore geoscience, defence R&D, and hydrography all have important sovereignty implications even though these programs have been established to meet other objectives. Similarly, many federal scientific research programs have industrial development, marine transportation or resource management implications.

Marine Transportation

The purpose of federal involvement in marine transportation is to provide a reliable, safe system for marine navigation, and to ensure marine safety and environmental protection through the effective regulation of ships.

The federal government provides a range of services, facilities and support programs targeted at the maintenance of a safe and efficient marine infrastructure. The major programs are delivered through Transport Canada and are designed to ensure marine safety

and environmental protection through the effective regulation of ships and the certification of personnel.

A significant portion of Transport Canada's marine budget is spent on marine navigation systems which include the following:

o short-range fixed and floating navigation aids such as lighthouses, range lights, buoys, etc. which mark channels, harbour entrances and obstructions;

o long-range electronic aids to help mariners determine the position of their vessels. These include Loran-C, Decca and radio beacons;

o provision and maintenance of waterways in support of commercial vessel movement and the guarantee of unobstructed passage;

o provision of vessel traffic services aimed at safety for marine traffic, e.g., marine safety information by way of radio broadcasts, publications and Notice to Mariners; and screening for defects or deficiencies in foreign vessels entering Canadian waters; and

o provision of ship-to-shore maritime mobile communication service for safety and public correspondence.

The Canadian Coast Guard is also responsible for marine regulations and ship inspections. This involves the development and enforcement of marine regulations aimed at pollution prevention and safety and takes the form of mandatory compliance checks. Some 4,700 ship safety inspections are carried out annually in Canada.

Icebreaking and other Arctic operations include route assistance through ice-infested waters, controlled break-up of ice jams in restricted navigable waterways and provision of ship time to other government departments and agencies.

Public Harbours and Ports are administered by Transport Canada at 476 locations across Canada.

The Atmospheric Environment Service of Environment Canada provides forecast and warnings services for the marine sector and information on ice and climate.

The Canadian Hydrographic Service of the Department of Fisheries and Oceans plays a major role in marine transportation. The Canadian Hydrographic Service has a mandate to gather and publish hydrographic data and navigational information relating to Canada's navigable waters. Its activities include hydrographic surveys, chart production, publication and distribution, production of tide, current and water-level data, production of sailing directions and small craft guides, planning, training and setting of standards for surveys and cartography, nautical geodesy, development and transfer of technology, and provision of specialized services related to hydrography and cartography particularly in the fields of maritime boundaries and marine litigation.

Other Marine Transportation Services

The Canadian Coast Guard has responsibility for the eastern Arctic sea lift of supplies to military outposts, remote settlements and remote Environment Canada weather stations.

Public Works Canada provides architectural and engineering services to governments and private clients on marine works such as docks, wharves and breakwaters. It also provides dredging services.

DFO's Small Craft Harbours program manages the operation and maintenance of 2,255 small craft harbours (1,419 harbours for commercial fishermen and 836 harbours for recreational boaters). DFO also provides information on waves, water levels and water temperatures for various marine engineering and aquaculture applications through the Marine Environmental Data Service.

The Energy, Mines and Resources offshore surveys program provides geodetic, topographic and geographic information which is important for offshore boundary establishment, as well as for the positioning of offshore activities such as drilling rigs.

Resource Development and Management

Federal programs related to resource management are intended to conserve, protect, develop and enhance the fisheries resource base; to assess the extent of non-renewable resources and facilitate their responsible exploration and exploitation; to prevent and control pollution; and to protect the habitat of marine organisms.

a) Living Resources

DFO has responsibility for the management, allocation and control of the marine fisheries in Canada. Activities undertaken to carry out that mandate include: resource assessment, licensing, allocation and regulation, enhancement and development, and monitoring control and surveillance. These operations are carried out on the Atlantic, Pacific and Arctic oceans.

DFO has also been given the lead role in developing an Arctic Marine Conservation Strategy, the purpose of which is to ensure the future health and well-being of Arctic marine ecosystems. This will enable Canada to fulfil its national and international responsibilities in the Arctic and to provide for sustained utilization of Arctic marine resources, particularly by Arctic peoples. An Arctic Marine Conservation Strategy Discussion Paper, released in January 1986, was used as a basis for extensive consultations

with industry, Native organizations, government departments and non-government agencies. A final document is being prepared for the consideration of Ministers.

Under the Migratory Birds Conservation Act, Environment Canada has responsibility for the management and protection of species of migratory sea birds. Environment Canada also coordinates polar bear research and management under the International Polar Bear Conservation Agreement.

External Affairs is responsible for Canada's international relations and works with DFO in the management of international fisheries relations, including negotiations of bilateral and multilateral treaties.

b) Non-living Resources

Non-living resources consist primarily of oil and gas and offshore minerals. Responsibility for the mapping of the geology and resources of the seabed for the evaluation and assessment of its mineral and resource potential resides with the Department of Energy, Mines and Resources (EMR) Geological Survey of Canada.

The regulation of oil and gas activities offshore and the calculation of the quantities of discovered oil and gas in frontier lands are the responsibility of the Canada Oil and Gas Lands Administration (COGLA) which is jointly administered by EMR and the Department of Indian Affairs and Northern Development (DIAND). For the Newfoundland and Nova Scotia offshore areas, the regulation of oil and gas activities is carried out by the interdepartmental joint federal-provincial management boards. COGLA's objective is to ensure vigorous and responsible development of petroleum resources on frontier lands within the prevailing policy and regulatory framework.

Offshore non-fuel minerals including sand and gravel, silica sands and gold-bearing sands are the responsibility of EMR south of 60° latitude and DIAND north of that line. Attempts are currently being made to improve the technical and geological information base and to promote a greater awareness of offshore mineral opportunities. Legislation to establish a framework for joint resource management with the coastal provinces is now in preparation.

c) Environmental Protection and Conservation

Environment Canada is responsible for environmental protection, marine industrial discharges from land-based industries, in co-operation with the provinces. Provincial agreements have primary responsibility pursuant to a Memorandum of Understanding between DFO and Environment Canada under which Environment Canada administers pollution sections of the Fisheries Act. The sections deal with the control of deposits of

deleterious substances into waters frequented by fish; ocean dumping under part VI of the Environmental Protection Act (CEPA) ; toxic substances under part II of CEPA; and ships wastes. Environment Canada also plays an advisory role in such areas as pollution risks associated with offshore fuel and mineral resources exploitation, environmental emergencies, shellfish protection and land-based pollutants. Under the Arctic Waters Pollution Prevention Act, COGLA and DIAND are also responsible for assuring environmental protection. COGLA is responsible for the regulation of incidental discharge of wastes from offshore drilling operators and DIAND is responsible for the regulation of non-ship waste discharge.

Environment Canada also establishes national marine parks under the National Parks Act to protect outstanding marine areas of national significance for the current and future generations of Canadians. It manages and protects unique marine habitats of wildlife and migratory birds.

The Canadian Coast Guard exercises on-site command and control of marine emergencies, including clean-up of ship-source pollution.

Scientific research by DFO is aimed at the conservation, restoration and development of fish habitat and the preservation of fish stocks. There is also a substantial amount of research aimed at marine environmental quality, based on the conservation and protection aspect of the habitat legislation.

EMR's Geological Survey provides information on seabed and coastal processes which must be evaluated in any environmental assessment of offshore and coastal activities. The Geological Survey of Canada's activities in marine geoscience research provides information towards studies of global climate change, particularly in respect to the role of sediment/water interactions and their effect on the carbon cycle and in assessing the occurrence, scope and impact of past climatic cycles through the information provided in the seafloor sediments.

d) Marine Environmental Quality

The federal government has a responsibility to ensure that the safety of life and economic security of Canadians are protected. One of the areas of constant danger to people who work or play in the oceans is the interaction between the sea and the atmosphere. Environment Canada is the federal agency with principal responsibility for the atmosphere portion of the air/sea interface, while Fisheries and Oceans is the agency with principal responsibility for the sea portion.

The Atmospheric Environment Service (AES) of Environment Canada provides a marine weather warning and forecast service for all marine areas under Canada's jurisdiction. AES also provides forecasts of sea state in the deep water areas of Eastern and Western Canada and ice forecasting services in Eastern Canada and the Arctic. These services contribute to environmental protection by the provision of an information service to marine operators. Through the use of weather, ice and sea state information as decision-making tools for

operations in the oceans, there is a reduction in the risk of environmental accidents. Marine climate information is also provided by AES and is used to design facilities for ocean operations as a planning tool for marine operations in support of energy exploration, mining transportation and fishing. The provision of day-to-day warnings, forecasts and marine climate services support sovereignty of Canada's ocean areas and assist in the management and regulation of ocean activities.

Sovereignty, Defence and Law of the Sea

Activities and programs in this category have the objective of affirming and enhancing Canadian sovereign rights as well as economic and political interests, and ensuring compliance with rules of international law and Canadian fishing and other resource regulations.

External Affairs has the primary role for coordinating issues relating to sovereignty. In maritime boundary negotiations, the role of External Affairs is to achieve acceptance of Canada's claims with respect to outstanding maritime boundary disputes. Canada is currently involved in disputes with the U.S., France and Denmark.

External Affairs coordinates measures to preserve sovereignty over the waters of the Arctic archipelago.

In consultation with other interested government agencies, External Affairs reviews foreign requests to conduct marine scientific research in offshore areas under Canadian jurisdiction.

A major task of External Affairs is to preserve and enhance Canada's sovereignty, foreign rights and Canada's political and economic interests related to Law of the Sea issues. External Affairs is currently leading the Canadian delegation to the United Nations Convention on the Law of the Sea Preparatory Commission which is attempting to develop a satisfactory seabed mining regime. Financial, economic, technical and mineral policy advice is provided by the departments of Finance and Energy, Mines and Resources.

External Affairs also plays a major role in the negotiation and interpretation of bilateral and multilateral fishing agreements.

DFO makes a considerable contribution to the exercise of Canadian sovereign rights through its hydrographic and other scientific activities. A further tangible expression of sovereign rights is the monitoring, control and surveillance of offshore fisheries. The objective of the surveillance is to ensure that foreign and domestic offshore fleets comply with fisheries management measures aimed at ensuring the conservation and optimal use of offshore fish stocks.

EMR contributes to Canada's sovereignty through its offshore survey program which provides geodetic information and through the geological and geophysical surveys which establish a Canadian presence in the area and provide the resource evaluation and

geoscientific knowledge for the delineation of offshore boundaries.

The role of the Canadian Coast Guard (Transport Canada) in Canadian sovereignty, particularly in the Arctic, is evidenced in its application of the Arctic Waters Pollution Protection Act.

Transport Canada is also the lead agency for the coordination of major Arctic transportation research and the promotion of a Canadian presence in commercial Arctic marine shipping through the Canarctic Shipping Co. Ltd.

Through Maritime Command, DND provides an operationally ready Maritime Force to meet Canada's defence commitments. In addition to its normal military roles, DND assists in enforcing Canada's sovereignty concerns by conducting surveillance patrols where activity is monitored within territorial waters and the 200 mile fishing zones on the coasts. As well, Maritime Command provides support to other departments and agencies (e.g., aircraft and warship support for DFO's fisheries surveillance and enforcement program). As discussed earlier, DND's maritime activities draw significantly on oceans-sector goods and services.

Environment Canada contributes to Canadian sovereignty through the provision of marine weather warning and forecast services for Canadian territorial waters out to the 200-mile limit. The development of national marine parks in the Arctic is another way in which Environment Canada will reinforce Canadian sovereignty.

Northern Development

The purpose of federal programs in northern development is to promote the development on northern resources while ensuring the integrity of the northern environment and the opportunity for Native people to pursue a traditional lifestyle. The lead role in the North is played by the Department of Indian Affairs and Northern Development. Its activities include:

- o oil and gas regulations north of 60° (through COGLA);
- o Indian and Inuit environmental protection;
- o identification of granular resources (sand and gravel) in the Beaufort Sea region;
- o allocation of granular resources and authorization of construction of man-made islands for petroleum development;
- o northern oil and gas resource management studies;
- o pollution prevention in Arctic waters through the management of non-shipping activities; and
- o northern land-use planning.

DFO activities in Arctic waters include fisheries and habitat management, hydrography and oceanography.

Besides its ice-breaking support and aids to navigation, the Canadian Coast Guard regulates the access of vessels to Arctic waters for purposes of safety and pollution prevention.

In cooperation with the Canadian Coast Guard, Environment Canada provides climate information and forecasts of weather and ice to support planning for and operation of marine transportation in the North.

EMR is responsible for the Polar Continental Shelf Project through which EMR maintains a comprehensive field support network of transportation and communication and provides professional, technical and managerial advice for research projects in the North. Geoscience studies in the Arctic are carried out by the Geological Survey of Canada through its Frontier Geoscience Program and its activities under the Federal Energy Research and Development Program.

In regard to international science and technology relations, the Department of External Affairs through the Interdepartmental Committee on International Science and Technology Relations (ICISTR) coordinates international Science and Technology initiatives relating to Cold Regions science and technology.

Industrial and Regional Development

The federal government has an important role in promoting the development of oceans-related industries. Industry, Science and Technology Canada (ISTC) has the objective of promoting the use of innovative science and technology to enhance the domestic and international competitiveness of Canadian firms. ISTC engages in a range of activities in support of business information and analysis, trade and market development, technology services and industrial development and targeted program support.

The Atlantic Canada Opportunities Agency (ACOA) was established in 1987 to promote economic development in Atlantic Canada. Commercial and non-commercial operations engaged in several sectors including aquaculture, business service industries, commercial research and development, the freight-forwarding industry, manufacturing, mining and related services, photogrammetry, storage and warehouse industries, and tourism and repair services are eligible for assistance.

ACOA also administers, on behalf of the federal government, the Canada/Newfoundland Ocean Industry Development Sub-Agreement. The objective of the six-year agreement, which terminates in March 1990, is full exploitation by local businesses and communities of the industrial R&D and supply opportunities arising from the offshore mineral developments, the fishery, and marine transportation. Assistance is available to Newfoundland-based firms engaged in applied R&D, technology application and transfer and the provision of specialized industrial expertise or services.

Pursuant to the offshore oil and gas resource management and revenue sharing accords

with the provinces of Newfoundland and Nova Scotia, Offshore Development Funds have been established. These funds are intended to help the provinces establish the infrastructure needed for oil and gas development. The federal contributions through the Newfoundland and Nova Scotia funds are respectively $300 million and $200 million.

The Department of Western Economic Diversification was established in 1987 to improve the economy of Western Canada by investing program funds in projects having the greatest potential for economic development and diversification. It provides financial assistance for projects involving the development of proposals, productivity improvement, research and development, marketing, establishment of new business and plant expansion. Individuals, private companies and non-profit organizations are eligible to apply for assistance. The provision of assistance is determined by the contribution each project would make to the diversification of the western economy.

The National Research Council (NRC), through the Industrial Research Assistance Program, facilitates the transfer of technology from government laboratories and universities to industry for commercial exploitation. Contribution arrangements involve cost-sharing between the NRC and the company.

Public Works Canada maintains and operates dry docks at Lauzon in Québec, Esquimalt in British Columbia and Selkirk in Manitoba in support of the ship-repair industry. Attempts are being made to sell the facilities and to achieve full cost-recovery.

Through DFO, agreements with the provinces are being negotiated to remove the regulatory impediments to the development of a viable commercial aquaculture industry in Canada.

External Affairs is active in defining and expanding markets abroad for Canadian fish and fisheries products. This involves the development and implementation of market plans, the provision of market assistance, promotional programs, interpretation of trade regulations, etc. Its Technology Inflow Program provides financial support (travel costs and accommodation) to Canadian companies wishing to access foreign technology.

EMR has established a project to assist Canadian companies in identifying foreign market opportunities for services and technology related to offshore mineral exploration and development.

The Canadian Oil and Gas Lands Administration is responsible for the implementation of "Canada Benefits" provisions in the context of work programs within offshore exploration licenses.

Marine Science and Technology Development

Federal programs in marine science and technology development are designed to provide scientific information and advice for the management of ocean resources, to support

scientific research in the ocean processes and to promote technological innovation in oceans-related industries.

As discussed earlier, an Interdepartmental Committee on Oceans is coordinating federal activities respecting marine science.

DFO has important responsibilities in marine science. Knowledge gained through marine science activities is an important element in management activities, regulation setting, design and construction, safety, environmental protection and conservation relating to oceans. Specific science programs within DFO include physical and chemical oceanography, marine ecology, habitat research and fisheries science. Extensive aquaculture and resource development research is conducted in support of the development of aquaculture as a viable and productive Canadian industry, especially salmonid enhancement and shellfish farming.

EMR's programs include: research on materials (steel and concrete) for offshore structures; offshore geoscience; survey and seafloor sampling instrumentation development; and remote sensing of natural resources and the environment.

On behalf of DIAND and EMR, COGLA administers the Environmental Studies Revolving Fund, which finances research studies required for regulating offshore activities through levies on oil and gas companies.

Environment Canada conducts research and development on pollution control, oil-spill cleanup and waste treatment technologies. It is also involved in the development of models for wind and waves, storm surge, oil slick trajectories, sea ice and iceberg forecasts and hindcasts and the development of marine climate applications for design and continuing planning. It also operates the Canadian Climate Centre where research is undertaken on climate prediction techniques, global atmospheric circulation modelling and the effects of CO_2 and other greenhouse effect gases on the ocean and the atmosphere. Both DFO and Environment Canada support university research in marine meteorology and climate. Environment Canada migratory bird and polar bear research involves status assessments, ecological studies, toxic chemical surveys and evaluation of threats posed by development activities.

The Canadian Coast Guard conducts both mission-oriented and operational R&D to allow marine operations in the Canadian Arctic on an extended-season basis. Close liaison is maintained with other departments through an Interdepartmental Committee on Arctic Marine R&D. Liaison with industry and provincial research centres are also supported

The marine focus of the National Research Council is on biology, chemistry and engineering. Emphasis is placed on client service and technology transfer to the private sector. This is accomplished through the provision of national facilities such as the Institute of Marine Dynamics in St. John's, Newfoundland and through financial assistance programs such as the Industrial Research Assistance Program.

The Natural Sciences and Engineering Research Council administers a program of scholarships and grants, the purpose of which is to promote and support the development

and maintenance of research in the natural sciences and engineering and to ensure the existence of highly qualified manpower in these areas.

The Interdepartmental Panel on Energy Research and Development, chaired and administered by EMR, coordinates the activities involved in the Federal Energy R&D Program. The Panel's resources augment existing budgets of the participating departments in order to accelerate and coordinate their response to federal energy policy objectives. These activities are conducted in many departments and provide major support for federal oceans-related programs.

Canada (primarily through EMR) participates in the Ocean Drilling Program, a U.S.-led international geoscienctific and technology development drilling program. The goal of the program is to improve the global understanding of the rocks and sediments beneath the oceans. Other federal departments involved include DFO, the Department of Industry, Science and Technology and funding assistance is provided by the National Research Council and the Natural Sciences and Engineering Research Council.

The Department of External Affairs acts as a focal point for coordinating bilateral and multilateral scientific activities under its international science and technology cooperation arrangements.

DND's Research and Development Program is aimed at improving the operational capabilities of the Canadian Forces by the application of advances in science and technology. Approximately $150 million was contracted out to Canadian industries and universities and other agencies for research and development activities in the fiscal year 1988-89. Additionally, the Department operates six research and development establishments across the country.

The Canada/Newfoundland Institute of Fisheries and Marine Technology Subsidiary Agreement was signed in May 1983 to establish an institute to meet the skilled training needs of offshore industries in Newfoundland and Atlantic Canada and in particular the fisheries, the offshore petroleum and merchant shipping industries.

GOVERNMENT/INDUSTRY INTERACTION

In September 1986, DFO sponsored Oceans Forum, a national conference at the Institute of Ocean Sciences at Patricia Bay, British Columbia. The theme of the conference was "Issues and Opportunities on the Oceans Frontier". The spectrum of interests represented at Oceans Forum included petroleum exploration and development, fishing, aquaculture, advanced technology manufacturing, a wide range of science-based oceanic services, shipping, ship-building, ocean law, oceanography and related sciences, and federal government departments with policies and programs involving oceans. The purpose of the forum was to provide representatives of the oceans sector and government with an opportunity to exchange views and to begin charting a long-term plan for Canada's oceans economy.

Although views were diverse, a consensus was reached regarding the need to establish a solid foundation for an oceans policy. In particular, three tasks were identified, namely:

1. to review and restate Canadian oceans policy, with a primary focus on the maximization of economic, scientific and sovereignty benefits to Canada;

2. to establish a framework of legislation which facilitates oceans development, particularly as it relates to the Exclusive Economic Zone as defined within the United Nations Convention on the Law of the Sea; and

3. to develop a consultative mechanism for industry, universities and other interests to express their views to government on oceans issues.

The Government of Canada has, in the time since Oceans Forum, actively pursued the realization of these three tasks. In 1987, the Department of Fisheries and Oceans released the publication entitled "Oceans Policy for Canada - A Strategy to Meet the Challenges and Opportunities on the Oceans Frontier". This federal oceans strategy reaffirms the objective of securing maximum social, economic, scientific and sovereignty benefits for Canadians from the oceans. It was prepared as the result of a process of consultation carried out throughout Canada with key players in industry, universities and the provincial and territorial governments.

The Department of Fisheries and Oceans has also taken the lead role in establishing a framework of legislation to facilitate oceans development. A Working Group of the Interdepartmental Committee on Oceans has given consideration to the establishment of an Exclusive Economic Zone and a Contiguous Zone. The Exclusive Economic Zone would extend 200 nautical miles seaward of the coastline, coinciding with the existing 200 nautical miles fishing zone. In such a zone, coastal states have sovereign rights to explore and exploit, to manage and conserve the living and non-living resources. A contiguous zone, which extends 12 nautical miles from the territorial sea or a maximum of 24 nautical miles from the shoreline, would allow Canada to establish controls to prevent infringement of

Canadian laws respecting immigration, sanitary, fiscal and customs matters. Although the establishment of these maritime zones would not increase Canada's powers or rights, it would:

- o Reaffirm Canada's commitment to a comprehensive and internationally acceptable law of the sea, as codified in the 1982 Law of the Sea Convention to which Canada is signatory;

- o Highlight the importance of the oceans sector in the national economy;

- o Increase public awareness of oceans-related issues; and

- o Strengthen Canada's oceans management regime.

Also, a Canada Oceans Act is being developed for consideration by the Interdepartmental Committee on Oceans and the Government. These Oceans Strategy initiatives will be the subject of extensive consultations by all parties involved.

In 1988, the Minister of Fisheries and Oceans announced the creation of the National Marine Council. It is composed of university and industry representatives active in the oceans sector. The National Marine Council is a consultative mechanism designed to advise the Minister on oceans-related policies and issues, provide him with private-sector views on the oceans economy, and offer the oceans sector a forum in which a wide range of interests can exchange views on the use, development, management and protection of Canada's oceans.

In addition to the above, the Government of Canada has recognized a need for increased awareness of the assistance and support available to the oceans sector. To this end, an interdepartmental working group reviewed federal assistance and support in this area and compiled an inventory for use by the oceans sector. As a result, the publication entitled "Inventory of Federal Assistance and Support Available to Canada's Oceans Industries" was published and is available from the Department of Fisheries and Oceans.

A broad framework is in place for the future development of Canada's oceans sector. Many challenges will have to be overcome before the objective of maximum economic, social, scientific and sovereignty benefits to Canadians is realized. However, through the cooperative efforts and the combined expertise of the public and private sectors, this objective will be achieved.

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APPENDIX:

INVENTORY OF FEDERAL OCEANS-RELATED ACTIVITIES

PROGRAM	DEPT.	LEGISLATION	$ M	PY's
1. Marine Transportation				
o Marine Navigation Systems	CCG	Canada Shipping Act	210	3300
o Marine Regulatory : Ship Safety	CCG	Canada Shipping Act	23	395
o Icebreaking and Other Arctic Operations	CCG	Arctic Waters Pollution Prevention Act National Transportation Act	90	1025
o Harbour Management	CCG	Public Harbours and Ports Facilities Act	37	90
o Hydrography	DFO	Government Organization Act 1979 Territorial Seas and Fishing Act Charts and Publication Regulations	40	585
2. Marine Services				
o Search and Rescue	CCG, DND, DFO	Safety of Life at Sea Convention, Canada Shipping Act	120	1820
o Ice Management / Flood Control	CCG	Department of Transport Act	6	65
o Eastern Arctic Sealift	CCG	Treasury Board Approval (June 1981)	7	11
o Marine Architecture and Engineering	PW	Public Works Act	250	340
o Dredging and Fleet Services	PW	Public Works Act	17	160
o Small Craft Harbours	DFO	Government Organization Act Fishing & Recreational Harbours Act	70	84
o Ice Services	DOE	Government Organization Act (1970 & 1979)		
o Marine Weather	DOE	Government Organization Act (1970 & 1979)	3.5	29
o Marine Climate	DOE	Government Organization Act (1970 & 1979)	1	5
o Offshore Surveys	EMR	Canada Lands Surveys Act (1970) Government Organization Act (1970 & 1979) Resource and Technical Surveys Act (1966-67)	0.3	6
o Marine Export Transport Services	EA	External Affairs Act (1983)	0.1	2

PROGRAM	DEPT.	LEGISLATION	$ M	PY's
3. Resource Development and Management (including environmental protection)				
o Fisheries Resource Allocation, Licensing and Regulations	DFO	Fisheries Act	13	200
o Monitoring, Control & Surveillance, Inshore and Nearshore	DFO	Fisheries Act Coastal Fisheries Protection Act	44	925
o Fisheries Enhancement and Development	DFO	Fisheries Development Act	68	420
o Habitat Management	DFO	Fisheries Act	6	75
o Arctic Marine Conservation	DFO	Fisheries Act		
o Petroleum Development - COGLA	EMR DIAND	Canada Oil and Gas Act Oil and Gas Production and Conservation Act Canada Petroleum Resource Act	6.5	60
o Control of Pollution from Land Based Sources	DOE	Government Organization Act (1979) Fisheries Act, Section 36-42 Canadian Environmental Protection Act (CEPA)	2	35
o Environmental Protection re. Offshore Petroleum and Mineral Resources	DOE	Government Organization Act (1979) Fisheries Act, Section 36-42 CEPA Part VI	1	9
o Toxic Substances Control	DOE	Fisheries Act, Sections 36-42 CEPA Part VI	1	12
o National Marine Parks	DOE	National Parks Act	0.3	3
o Control of Ship-Source Discharges	CCG	Government Organization Act (1979)	0.2	3
o Marine Environment Protection World-wide	EA	External Affairs Act (1982)	0.3	2
o Emergencies / Clean-up of ship source pollution	CCG	Canada Shipping Act	5	60
o Pollution Prevention in Arctic Waters	DIAND	Arctic Waters Pollution Prevention Act Emergency Planning Orders	0.2	4
o Framework for Development of Offshore Non-Fuel Minerals	EMR	Energy, Mines and Resources Act	0.3	3
o Offshore Geoscience Information	EMR	Resource and Technology Surveys Act Energy, Mines and Resources Act	14	75
4. Sovereignty, Defence and Law of the Sea				
o Maritime Boundary Disputes	EA	External Affairs Act (1983)	0.2	5
o US-Canada Arctic Cooperation and Coordination	EA	External Affairs Act (1983)	0.1	1.5
o Law of the Sea		External Affairs Act (1983)	0.1	1

PROGRAM	DEPT.	LEGISLATION	$ M	PY's
o International Fisheries Agreements (resources shown for External Affairs only)	EA DFO	External Affairs Act Fisheries Act	0.2	6
o Maritime Command	DND	National Defence	2260	18448
5. Northern Development				
o Northern Land Use Planning	DIAND	Indian Affairs & Northern Development Act	2	22
o Indian and Inuit Environmental Protection	DIAND	Indian Act	0.5	1
o Studies for Northern Oil & Gas Resource Management (NOGAP)	DIAND	Indian and Northern Affairs Act	1	5
o Granular Resources and Man-made Islands in Beaufort	DIAND	Public Lands Grants Act	0.4	1
o Petroleum and Related Environmental protection - COGLA (resources reported under "C")				
o Arctic Icebreaking (resources reported under "A")	CCG	Canada Shipping Act Arctic Waters Pollution Prevention Act		
6. Industrial Development				
o Action Program	ACOA	Government Organization Act, Atlantic Canada 1987	*	*
o Newfoundland Ocean Industries Development Agreement	ACOA	Economic and Regional Development Agreement	*	*
o Canada-Nova Scotia Development Fund	COGLA	Federal/ Provincial Agreement (1984)	*	*
o Canada-Newfoundland Offshore Development Fund	COGLA	Canada-Newfoundland Atlantic Accord - Implementation Acts	*	*
o Western Diversification Program	WDO	Western Economic Diversification Act (June 8, 1988)	*	*
o Operation and Maintenance of Certain PWC Dry Docks	PW	Public Works Act	4.6	53
o International Fish Trade Development	EA	External Affairs Act (1983)	0.4	8
o Program for Export Market Development	EA	External Affairs Act (1983)	5.0	-
7. Marine Science and Technology Development				
o Fisheries Resource Assessment Research	DFO	Fisheries Act	75	930
o Aquaculture Research	DFO	Fisheries Development Act	7	105

PROGRAM	DEPT.	LEGISLATION	$ M	PY's
o Habitat Assessment and Research	DFO	Fisheries Act	8	110
o Resource Development Research	DFO	Fisheries Development Act	20	195
o Physical Oceanography	DFO	Government Organization Act 1979	27	361
o Chemical Oceanography	DFO	Government Organization Act 1979	7	107
o Marine Ecology	DFO	Government Organization Act 1979	14	179
o Offshore Geoscience Activities	EMR	Resource & Technical Surveys Act Energy, Mines and Resources Act	9	110
o Materials for Offshore Structures	EMR	Energy, Mines and Resources Mandate/PERD	2	9
o Remote Sensing Relating to Oceans	EMR	Treasury Board Minute Energy, Mines and Resources Act	0.2	1
o Ocean Drilling Program	EMR/ et al	Cabinet Decision	4	3
o Marine Engineering (includes $1.5 M IRAP)	NRC	NRC Act (1966-1967)	10	60
o Marine Biology and Chemistry (includes $1.5M IRAP)	NRC	NRC Act (1966-1967)	5	-
o Grant Support to Universities	NSERC	NSERC Act	9.8	-
o Climate Research	DOE	Government Organization Act 1979	1	5
o Defence R & D[1]	DND	National Defence Act	267[1]	15971[1]
o Arctic R & D	CCG	Arctic Waters Pollution Prevention Act	2	3
o Technology Inflow Program	EA		*	-
o Industrial Research Assistance Program	NRC		*	-
Total Oceans-Related Activities				
Excluding Maritime Command			1520	13682
Including Maritime Command			3780	32130

Note: Most of the financial data relates to fiscal year 1988/89

* - These assistance programs and activities are not targeted exclusively at the oceans sector. More detailed descriptions and information on funding levels is included in the publication entitled "Inventory of Federal Support Available To Canada's Oceans Industries", available from the Department of Fisheries and Oceans.

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1 - Slightly more than one-third of this program is oceans-related.